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ABSTRACT

A description is given of a cooperative learning experience conduct with small groups of racially mixed, underachieving high school students. Twenty-nine students were organized in groups of three or four members each. The groups worked together in all laboratory assignments and daily work, and studied together for quizzes and tests in a science class. The students were graded as a group. The effectiveness of the treatment was determined by comparing the six weeks grade averages for the fourth, fifth, and sixth grading period. A comparison of the averages revealed no statistically significant differences between them. While the experiment was not successful in increasing the sample's six weeks grade average, an improvement was noted in the classroom atmosphere and the students were apparently more motivated to achieve good marks. (JD)

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COOPERATIVE LEARNING IN AN URBAN SCIENCE CLASSROOM

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COOPERATIVE LEARNING IN AN URBAN SCIENCE CLASSROOM

INTRODUCTION

The below level students at MacArthur Senior High are a varied group. Classes containing these students are made up of learning disabled students, slow learners, and students who are capable of level or above level work. The level and above level students have been placed in basic classes because they have caused a variety of discipline problems. Teaching physical science to students of these varying abilities has been a challenging and often frustrating task. Some students lack not only basic reading and mathematics skills, but also lack necessary social skills.

MacArthur High is a school in transition. Fifteen years ago the population was White middle class. The ethnic makeup of the school then began to change. The small Black minority began to grow. Many of these students were bused in from outlying areas. The Hispanic population also increased. During the 1988-89 school year, the ethnic makeup was approximately 46% Hispanic, 28% Black, 24% White, and 2% Asian (Drawhorn, 1989). Racial conflict has increased as the population has changed. Tension is sometimes evident in the classroom. Students often ridicule the language or dress of people from other backgrounds.

The students from MacArthur do not communicate well with each other. Conflict is often a direct result of a misunderstanding due to different backgrounds. Development of social skills would benefit the students now and later, when they enter the job market. One instructional intervention cited frequently (over 3000 in ERIC in 3 years) which emphasizes the development of both academic and social skills is cooperative learning.

Cooperative learning has improved social and academic skills in past studies (Slavin, 1987). Cooperative learning situations have enhanced science classes. The interdependence among group members often has led to peer tutoring situations where group members share skills among the group (Johnson, 1987). Increasing the self esteem of individuals within the classroom often decreases the amount of conflict. Students who feel powerless frequently will use confrontational means to gain attention. William Glasser states that increasing the amount of classroom time that students have to socialize while they work will improve the atmosphere in the classroom (Brandt, 1988). The combination of needs at Macarthur High School seemed an ideal situation for a cooperative learning experiment.

STATEMENT OF PROBLEM

Students enrolled in Introductory Physical Science need to improve reading, writing and observational skills. The hypothesis is: in a controlled cooperative learning situation, below level physical science students will improve their academic skills resulting in higher grades.

SAMPLE

Students in the sample were enrolled at MacArthur Senior High School during the 1988-89 academic year. MacArthur is located in the Aldine Independent School District, an area of Northern Harris County in Houston, Texas. The majority of the students came from families with low socioeconomic status. Approximately two thirds of the sample were classified slow learners, and one third were capable of level or above level work, but had a history of discipline problems or truancy. Five of the 29 students were diagnosed as learning disabled.

There were fifteen males and fourteen females in the sample. Of the males, 5 were Black, 1 was white, and 9 were Hispanic. The female sample consisted of 5 Blacks, 2 Whites, and 7 Hispanics.

Fourteen of the students were enrolled in my third period class, while the others were enrolled in my sixth period class.

TREATMENT

The students were divided into groups of 3 or 4 individuals. There were 2 groups of 4 and 2 groups of 3 in each class. Previous academic performance was taken into account when forming the groups. Each group was made up of 1 high achiever, 1 low achiever, and 1 or 2 middle achievers. The students were not allowed to change groups. Race and sex were not considered in group formation, however each group proved to be heterogenous for these two variables. Seating charts were made so the groups sat together. The groups worked together every day.

Students were given one of four assignments within the group: recorder, materials handler, group leader, or principal investigator. The students rotated jobs on a weekly basis.

The recorder was responsible for keeping records for the group. Only one lab report was accepted from each group, it was the responsibility of the recorder to see that all necessary information was in the report. The materials handler gathered the items necessary for each lab. This student was responsible for the return of all items to the lab instructor. The materials handler was also held responsible for the condition of the work area and all materials used by the group.

The principal investigator read thermometers, kept time, read meter sticks, etc. The group contributed to the

investigation, but the principal investigator was responsible for reporting to the recorder.

The group leader led discussions, maintained peace within the group, and checked all materials and work before they were handed in to the teacher. In instances where the group was unable to agree on a single answer, it was up to the leader to choose the course of action.

The groups worked together on all laboratory assignments, daily work, and studied together for quizzes and tests (some classroom time was used for group studying). A group grade was given for labs and daily work. The lab grade was based on a written report or worksheet and the group's performance in the lab. Performance included the condition of the workplace, condition of materials returned, and number of times the instructor had to admonish the group for misbehavior. Running in the lab, playing with equipment, hitting another student, sleeping, or unnecessary loudness were the usual reasons for instructor correction of a group. The written report accounted for seventy-five percent of the grade and performance was the remaining twenty-five percent. Daily grades were figured by an average of all papers turned-in to the teacher. If one group member did not turn in work, a zero was averaged with the other scores. On some daily assignments, only one paper was completed per group. Students who were absent had to do the daily assignments as make-up work. These students had one week to complete missing assignments. When calculating the six week average, the average of

the daily grades was sixty percent of the total and the average of the tests, including the six week exam, was forty percent of the total.

The cooperative learning experiment was conducted during the fifth and sixth six week grading periods. The students were put into groups at the beginning of the fifth six weeks. A number of cooperative learning exercises were completed by the classes to accustom the students to the principles and skills needed to successfully work as a group. The first exercise involved putting puzzles together. Each group was given three or four envelopes. The envelopes contained parts to various puzzles. There was one complete puzzle for each student. The group members were not allowed to talk. Students had to offer pieces of puzzle to other members when they saw that the others needed the pieces. Asking for the pieces in any way was not allowed. After all the groups had successfully completed their puzzles, the class discussed the emotions they had experienced. Then the groups exchanged envelopes and repeated the exercise.

After the third repetition, all the group members were cooperating with each other. The students asked to continue the exercise and compete with other groups in the room. Competition was not encouraged between the groups. In both classes, the exercise appeared to bring members together. Members who had appeared to be intimidated or unhappy with their groups were cooperating and contributing at the end of the period.

The next day, a number of minilab exercises were completed by each group in the sample. These included measuring the length of various objects, weighing an assortment of beakers, identifying changes as physical or chemical, and timing a pendulum. After the introductory period, class proceeded as usual. The groups remained intact until the end of the semester.

ANALYSIS

The effectiveness of the treatment was determined by comparing the six weeks grade averages for the fourth, fifth, and sixth grading periods. Data were collected for daily, test, and six weeks averages for each of the grading periods. Table 1 shows the mean and the standard deviations for the dependent variable data collected.

TABLE 1
STANDARD DEVIATIONS AND MEANS OF DEPENDENT VARIABLES

	4D	4T	4A	5D	5T	5A	6D	6T	6A
MEAN	85.31	76.52	81.93	78.90	77.76	78.90	81.55	80.9	81.38
SD	8.79	12.17	7.63	16.16	11.23	11.80	12.37	12.57	11.18

D=DAILY GRADE

T=TEST GRADE

A=AVERAGE FOR GRADING PERIOD

Dependent t-tests were calculated comparing the averages of the fourth to the fifth, fourth to the sixth, and fifth to the sixth grading period. In each case, the resulting t-ratio was not statistically significant, indicating that there were no significant differences between the averages (See Table 2).

TABLE 2 T-TESTS ON 6 WEEK GRADE AVERAGES FOR TREATMENT EFFECTS

ACROSS TIME PERIODS

VARIABLE	A4---A5		A4---A6		A5---A6	
MEAN	81.93	78.98	81.93	81.38	78.90	81.38
STANDARD DEVIATION	7.63	11.80	7.63	11.18	11.80	11.18
STANDARD ERROR (DIFFERENCE)	1.42	2.19	1.42	2.08	2.19	2.08
MEAN	3.03		0.55		-2.48	
STANDARD DEVIATION	11.75		12.82		12.87	
STANDARD ERROR	2.18		2.38		2.39	
CORR.	0.33		0.11		0.37	
2-TAIL PROB.	0.18		0.81		0.31	

The failure of the treatment to yield the expected results may be explained in a variety of ways. A multiple regression procedure in which gender, race, class absences, and instructional period served as predictors in a full model with the criterion variables being the final 6 week averages was calculated to determine whether these contextual variables influenced the 6 week averages of the subjects(See Table 3).

TABLE 3

MULTIPLE REGRESSION PROCEDURE TO DETERMINE EFFECTS OF CONTEXTUAL VARIABLES ON ACHIEVEMENT

$$\text{EQUATION } Y = a \text{ GENDER} + b \text{ ABSENCES} + c \text{ RACE} + d \text{ PERIOD} + \text{CONSTANT}$$

MULTIPLE R^2 = .65
 ADJUSTED R^2 = .37
 STD. ERROR = 8.85

ANALYSIS OF VARIANCE

	DEGREES OF FREEDOM	MEAN SQUARE
REGRESSION	2	732.1
RESIDUAL	26	78.3
F = 9.36	SIG F = .0009	

VARIABLE	BETA	T	SIG. T
GENDER	.47	3.2	.004
ABSENCES	-.42	-2.8	.009
RACE	-.22	-1.5	.154
PERIOD	.17	1.1	.282

According to the multiple regression procedure, gender accounted for 21% of the variance of the 6 week average and absences accounted for 16% of the variance.

CONCLUSION

According to Johnson and Johnson, research has shown that students are more motivated to learn, more self-confident, and learn more material in a cooperative learning climate than in a traditional classroom (Johnson, 1987). The science classroom has been an arena in which successful cooperative learning experiments have often been conducted in the past (Slavin, 1988). Why then was this experiment not successful in increasing the sample's six weeks average?

Cooperative learning is a recursive exercise. Teachers learn their roles in cooperative learning from practice over time, as do the students. The groups and the teacher need time to adjust to the new demands of the non-traditional classroom. As the methods become more familiar, the process is refined and cultivated to meet the needs of the learners (Sharan, 1987). A number of factors contributed to decreased time for adjustment to the new methods.

If the treatment had been incorporated from the beginning of the year, students and teacher would have been more comfortable with the new procedures and possibly academic performance would have improved.

The average number of absences per sample subject for the semester was 6.2. The averages for the fifth and sixth grading period were 2.4 days and 2.3 days respectively. In addition to regular absences, many students spent time in SAC or in-school suspension. Eleven students spent a total of 87 days in SAC, for an average of 7.9 days per student. Students were removed from the classroom for counseling, discipline, and testing. The interruptions undermined the cooperative learning benefits, at least for those individuals. Groups were often one or, occasionally, two members short, so group dynamics also suffered.

Six week averages of below fifty were not recorded. The teacher was not allowed to award a grade of less than fifty because of the school grading policy. This resulted in three recorded grades that did not reflect the actual grade of the students. This required grade adjustment may have affected the statistical significance of variables used the analysis.

Applying the treatment during the last third of the school year probably affected the results. The students were less motivated and eagerly anticipating the end of the year.

Even though no academic improvement was noted in terms of the 6 week grade averages, the classroom atmosphere improved. Fewer students were sent to the counselor's office for racial

comments. The students worked well in their heterogeneous groups. As the semester progressed, the groups became cohesive units. The students supported group members. Groups tended to police themselves. When a member became loud or violated other rules, he or she was cautioned by others in the group. The sample members appeared to desire good laboratory grades. In the past, grades had not been a motivating factor. In fact, students had often compared scores and celebrated having low marks.

The research project was a success in another way. The project was undertaken as partial fulfillment of requirements for an alternative certification and Master's program at Texas A&M University. This was included in the program to provide classroom teachers with research experience. As a result, I have developed an appreciation for and an interest in classroom research. The development of my next hypothesis and treatment will benefit from this experiment.

Cooperative learning is a viable alternative to the traditional classroom. The positive effects shown on learner attitudes are reason enough to use this tool. I will continue to use cooperative methods in my classroom. I believe that further research will prove the benefits of cooperative learning, especially in below level classes.

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